

Impact of climate change on St. Martin's Island

Global climate change poses a high risk to the biodiversity of coral reefs of St. Martin's. The major threats to the coral reefs are high levels of sedimentation, cyclones, storm surges and beach erosion. Global warming is a matter of major concern for coral reefs of this island as elsewhere.



DR. MD. MIZANUR RAHMAN

ST. MARTIN is a tiny island in the Bay of Bengal approximately 9 km south of the Cox's Bazar-Teknaf peninsula. It is the southernmost part of Bangladesh and is locally known as Nariel Jinjira (Coconut Island). St. Martin's Island is a stock of extraterrestrial, marine and land resources. Depending on tidal level the surface area is about 8 kilometres and the beach length is about 14 kilometres. This is the most attractive tourist spot of Bangladesh.

The biodiversity of St. Martin's island is characterised by mangrove forests, seaweeds, corals, turtles, crabs, fish, seabirds, coconut trees and Pandanus vegetation. The island is a unique example of co-occurrence of different ecosystems. Mangroves are home to corals, crabs, sea weeds and sea birds, and provide excellent nurseries for marine fishes. It also protects the inhabitants from the storm surges, cyclones and tidal waves, and prevents the island from erosion.

Screw pine (Pandanus) is one of the iconic tree species of this island. It grows on exposed mainland and along beaches, and has thick 'prop roots' to anchor itself in the loose sand. The island is a congenial habitat of a diverse coral community represented by approximately 66 Scleractinian coral species, of which 19 are fossil corals, 36 are living corals and 11 are soft corals (Tomascik 1997). About 14% area of this island is visited by 03 species of marine nesting turtles including Olive Ridly. All of them are considered

as globally endangered by IUCN.

This is also a suitable habitat for different species of multi-colour ornamental fishes. During the year 1997, 240 fish species were recorded from the catch landed on this island and 86 of them are coral associated (Tomascik 1997). The abundant coral associated fishes are Damsel, Parrot, Surgeon, Groupers, Snappers, Emperors and Butterfly fish (Haider 2008). 186 species of mollusc and oyster, 7 species of crab, 9 species of echinoderms, 4 species of sea urchin, 1 species of sea cucumber, some brittle stars, 5 species of marine mammals, a number of colourful nudibranch and bryozoans, 14 species of algae, 29 reptilian species and 120 species of birds (out of them 53 species are migratory) were recorded at the St. Martin's Island.

Impact on biodiversity

Coconut trees: Reproductive development of coconut tree is highly sensitive to high temperature and water stress. The fruit set is adversely affected, mainly due to a reduction in pollen viability. The nut development is affected mainly resulting in small number of nuts, empty nuts or elongated nuts.

Mangrove forests: Sea level rise will cause a major threat to mangrove ecosystems through sediment erosion, inundation stress and increased salinity at landward zones. These problems will be exacerbated for mangrove stands of this island due to 'coastal squeeze' (landward migration is restricted by smaller size and human settlements). High rainfall and silts being washed down can also affect

mangrove growth weakening its resilience.

Screw pine (Pandanus): Increasing salinity will cause high mortality of Pandanus trees. The removal of Pandanus trees will enhance beach and dune erosion. **Seaweed:** Ozone layer depletion will allow a greater amount of ultraviolet rays that can be harmful for seaweeds. UV rays decrease photosynthesis and productivity of seaweeds and directly affect biomolecules.

Sea-algae: 40% algae population may die due to climate change by the end of this century (Muller 2009).

Coral: Global climate change poses a high risk to the biodiversity of coral reefs of St. Martin's. The major threats to the coral reefs are high levels of sedimentation, cyclones, storm surges and beach erosion. Global warming is a matter of major concern for coral reefs of this island as elsewhere. The most noticeable damage caused by high sea temperature is coral bleaching. Coral bleaching turns into colourless ugly coral. Coral reefs have already suffered major mortalities as a result of high-temperature events. It is also dependent on a species of algae that lives symbiotically in its body and produces additional food by photosynthesis. When the sea temperature rises above 28°C, the coral expels the algae and consequently it starves.

Turtle: Sea-level rise causes erosion of turtle nesting beaches. Higher sand temperature leads to changes in sex ratios or prevent eggs from hatching. Coral reefs are essential feeding habitats of turtles. Coral bleaching destroys the feeding sources of turtles. Huge rainfall can raise ground water tables, thereby flooding nests of turtles.

Mollusc: Sea acidification will decline the abundance of mollusc.

Crabs and shrimps: Due to sea level rise, the breeding place of crabs and shrimps will be destroyed.

Sea fish: Fishes will lose their habitats with coral bleaching and mangrove destruction.

Seabirds: High sea temperature will affect seabird foraging success, growth patterns and reproductive potentiality. Coral bleaching increases surface temperature, which decreases breeding and populations of seabirds.

How to mitigate

- To strengthen monitoring of biological resources and impact of climate change for appropriate biodiversity management
- To develop alternative livelihoods for the people who are dependent on coral resources
- To establish an appropriate conservation strategy
- To emphasise the conservation programme of coral ecosystem and protection of migratory birds
- To keep the turtle's habitat undisturbed
- To involve NGOs in the conservation programme
- To establish an information system of biodiversity of this island
- To strengthen research work on the impact of climate change
- To emphasise ex-situ conservation of endangered species
- To measure the adverse effects of natural calamities, global warming and sea level rise
- To create public awareness by using different media
- To raise funds for conservation programme
- To implement ecosystem approach and community based conservation programme by involving local people
- To maintain and restore mangroves for reducing erosion
- To establish mechanisms to promote carbon uptake

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Coral beach

How effective is a non-binding climate change deal?

The performance of the industrialized countries, according to Kyoto Protocol, does not speak bright for this planet's future and humanity at large. If the Copenhagen accord did not act and monitor the projects to be undertaken by the developed and developing countries the situation on the planet would simply become worse.



MOHAMMAD AMJAD HOSSAIN

THE well-talked and publicized Copenhagen UN conference on climate change could not bring desired results as the deal to limit global temperatures rise to below two degrees Celsius was struck, but remains non-binding. Critics of the conference hold the opinion that it would be difficult to reach the target without specific commitments to reduce carbon emissions by the leaders of the industrialist countries in particular and emerging global partners like China, Brazil, India and South Africa

CO2 emissions, pollution and greenhouse gases are mainly the product of the industrialist countries while neo developed countries like China, Brazil, India and South Africa are also now responsible. Admittedly, the least developed countries should not be accountable for the environmental hazards.

Scientists and political leaders are unanimous that climate change poses serious threat to humanity, but there have been deep differences between rich and poor countries, which demand billions in subsidy to reduce their own reliance on fossil fuels; resistance to limit binding

change or no climate change these should be taken to mitigate environmental degradation.

Being a lower riparian country Bangladesh is being affected by floods every year. Therefore, Bangladesh needs international assistance for dredging dried up rivers to contain waters coming from upper riparian during rainy season in particular. India may also be asked to compensate for devastating floods causing distress for the people and country's economy as well. Similarly, India should be asked to honour her commitments to supply needed waters from the Ganges during lean period to save the country from drought.

On the other hand, ancient glaciers in the Himalayas and the Alps are visibly melting while the sea ice at North Pole is thinning faster than thought due to global warming. These are the reasons for sea level rise. In course of a short time the southern region of Bangladesh in fact would be engulfed in waters. Bangladesh needs technologies from industrialized countries to save southern part of the country. The Copenhagen accord, however, committed to provide "adequate, predictable and sustainable financial resources, technology and capacity-building" for the implementation of adaptation plan. The government needs to prepare comprehensive plan to save southern part of the country. Deforestation is contributing 20 percent of global carbon emission. And deforestation in the Himalayan region should be held responsible for contributing to the degradation of environment. In this connection Bangladesh can claim financial assistance for large scale planting trees along the coastal belt. I understand Bangladesh is spending around \$ 50 million on adaptation and will include ways to fend off rising sea levels in the line of the Netherlands.

It is imperative to address poverty problem that Bangladesh is confronted with. The government should consider adopting such projects which could



Melting polar ice.

in general.

It is understood that US President Barack Obama has played a crucial role to bring the leaders of China, Brazil, India and South Africa on the negotiating table to strike the deal "to set a mitigation target to limit warming to no more than two degrees Celsius". An appendix will be added to the agreement to specially lay out each country's commitments for climate change.

On financial position there have been not many commitments. America and other developed countries committed to provide \$ 30 billion in 2010 and 2012 with balanced allocation between adaptation and mitigation and developed countries also pledged to mobilize globally \$ 100 billion by 2020. It means that the least developed and countries most vulnerable to climate change would be benefitted from the fund from 2010 to 2020.

It is true that the current problems of

emissions; and allay skepticism raised by the 'climate gate e-mails scandal'.

China, Brazil, India, South Africa and America announced independent non-binding climate goals in advance of the conference. In Bangladesh, many old and worn out vehicles are causing environmental pollution. The government does not need money to phase out such vehicles from the roads. These vehicles should be phased out immediately to improve environment. River side should not be made dumping ground of waste under any circumstance. Municipal Corporation's may have to find suitable location for dumping of waste. Law should be enacted to punish anybody violating the provision. Tanneries at Hazaribagh almost at the heart of Dhaka city are causing serious environmental hazards indeed. Location of tanneries needs to be moved out from the heart of the city. These are local efforts. Climate

provide employment to a vast section of population of the country. There is a need for concerted efforts against poverty.

The performance of the industrialized countries, according to Kyoto Protocol, does not speak bright for this planet's future and humanity at large. Copenhagen accord, however, acknowledged the impact of climate change. If the Copenhagen accord did not act and monitor the projects to be undertaken by the developed and developing countries the situation on the planet would simply become worse. Only redeeming feature of Copenhagen conference is that America, biggest emitter of carbon, under the leadership of Obama is no longer an obstacle in contrast to President George W. Bush, who failed to embrace emissions reductions.

Mohammad Amjad Hossain, a retired Bangladesh diplomat, writes from Virginia.

Humans, water and climate

According to the 'Intergovernmental Panel on Climate Change' (IPCC), water is involved in all components of the climate system; therefore, climate change affects water through a number of mechanisms.

DR. MD. RASHED CHOWDHURY

CLIMATE change will significantly alter the hydrologic cycle at global and regional scales, with impacts on freshwater resources, land use, and land-atmosphere feedbacks. However, the effects of climate change on the hydrologic cycle, and hence on water resources, are difficult to predict because of the complexity of the natural system, the many coupled physical processes, the scientific uncertainty, the wide range of future greenhouse gas emission scenarios, and the dependence on human factors such as government policy and public understanding of the problem. Climate change impact studies must therefore consider the full spectrum of these issues and expect to be scrutinized for their realism, sophistication, and robustness.

Recent work has demonstrated that land-atmosphere feedback and hydrologic response under climate change depend on the quantity, move-

ment, and distribution of groundwater. These feedbacks are not only critically important to predicting hydrologic response to climate change, they also indicate any water management practices that change the depth to water table, e.g., pumping groundwater for agricultural or municipal use, or groundwater banking. Feedbacks between water management and local climate would change the scale of human-climate interactions from strictly global to highly local and could notably change the way that scientific information on climate should be communicated to the public, particularly water managers, to better inform such local policy decisions.

Therefore, there is a need to address both the scientific question of feedbacks between water management and local climate, and the sociopolitical question of understanding and improving communication between climate scientists, local decision makers and the public. Collaborative research and education will improve our understanding of the link between the human and natural systems

and help to manage and adapt our water resources in a changing climate.

It is now necessary to use two fully coupled groundwater-land surface-atmosphere models to investigate the connections between global climate change, regional climate feedbacks, and local water resources practices. This will allow investigating hydrologic response and climate feedbacks over a range of scales. Furthermore, it will investigate the link between local-scale water management decisions and climate change by implementing a three-part ethnographic study of scientific communication between climate scientists, water managers and students, and the public. In particular, this will examine how modeling simulations and results can best be communicated to the stakeholders (water managers, students, and the public), explore where the most effective communication occurs, and identify existing barriers to communication. The relationship between these human and natural scales, systems and feedbacks is shown in Figure 1.

In the context of Bangladesh, any research plan related to investigating hydrologic response and climate feedbacks should include the following key questions:

- What is the effect of climate change on local hydrologic variables that impact water resources such as water table

depth, stream flow, evapotranspiration, and runoff? What are the regional differences between the watersheds in the vulnerability of water resources to climate change?

- What are the effects of local water management practices, such as groundwater pumping, irrigation, and groundwater banking, on hydrologic response, land-atmosphere feedbacks, and climate change?

- How does human participation enter into local water resources management decisions and dissemination of scientific information? How can scientific research be effectively communicated to local decision makers? How does the propagation of information influence the feedback between human and natural systems?

- What role should climate scientists play in shaping policy? What kinds of alliances or relationships can climate scientists form with local policymakers, and what are the risks and ethics involved in such alliances?

- How can the results of these detailed, scientific studies be integrated into the undergraduate and graduate curricula to better educate future water engineers and managers? How can these results be shared with the public?

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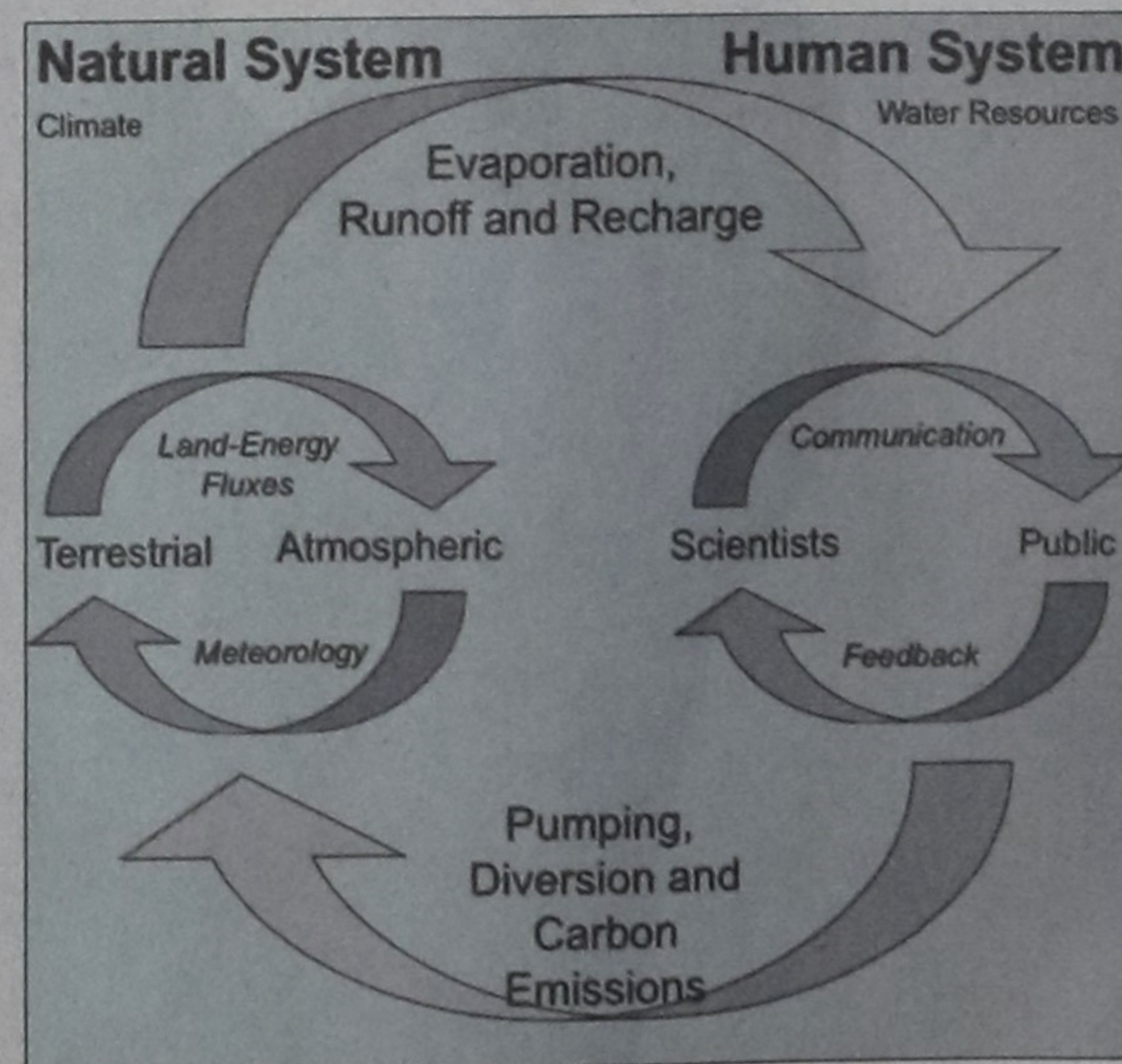


Figure 1. Diagram illustrating the interdependence of human water use and the natural hydrologic system. Note the linkage between terrestrial (surface and subsurface) and atmospheric hydrologic cycles and the key mechanisms that provide feedbacks between the human and natural systems.